Bioeconomy and Circular Economy
Principles, Challenges and Open Questions

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Bioeconomy and Circular Economy

Introduction

In the relatively short time we have been walking the Earth, humans have left an undeniable impact on the planet.

Now scientists have unanimously agreed that our actions have altered the Earth's natural processes enough, to enter in a new geological epoch.

Ladies and gentlemen, welcome to the Anthropocene.

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Introduction

The *Anthropocene* (or anthropogenic) defines Earth's most recent geologic time period as being human-influenced.
It is based on overwhelming global evidence, that atmospheric, geologic, hydrologic, biospheric and other earth system processes are now altered by humans.

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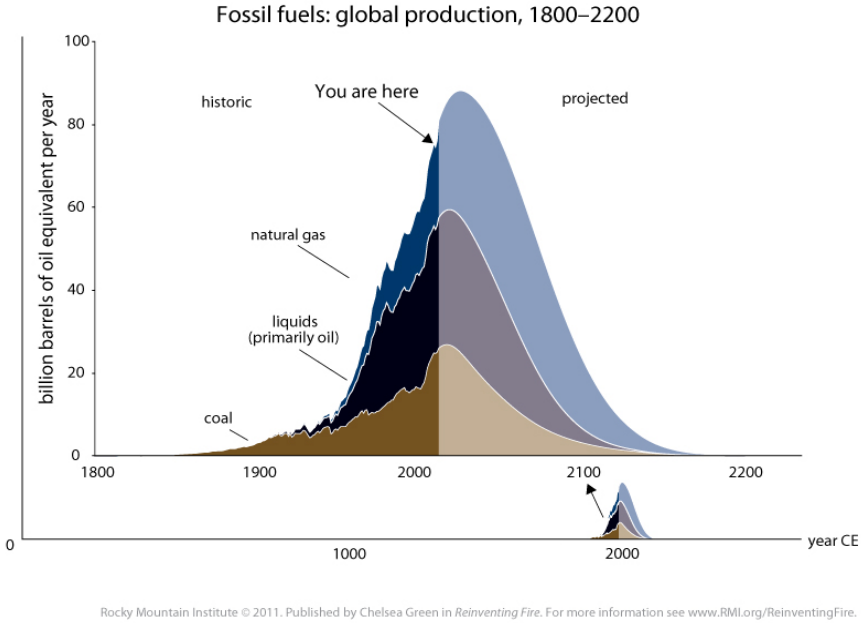
Introduction



Traditional Bioeconomy

Now

Modern Bioeconomy

Fossil-fuels are biomass stored in geological form. They are the accumulated energy of 500 million years of photosynthesis.

This sounds reassuring, but it is not, since we have consumed between 1950 and 2010, 50 - 150 million years of stored sunshine, according to McNeill & Engelke, 2013).

The Bioeconomy Circular Economy era

Bioeconomy and Circular Economy

Principles

Definition: Bioeconomy **is research and innovation to produce renewable raw materials sustainably in agriculture, forestry, fisheries and aquaculture and to process renewable raw materials into value added products in the food, bio-based and energy industries.**

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Principles

Another definition: Knowledge Based Bio-Economy (KBBE)

The knowledge base: Advances in Life Sciences and Biotechnologies in convergence with other technologies such as nanotechnologies, chemistry, information technologies etc.

The Bio-Economy: Includes all industries and economic sectors that produce, manage or otherwise make use of biological resources including bio-waste.

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Principles

Biological resources is the heart of the Bioeconomy and represent 4 unique features:

- **Renewability**
- **Carbon-friendliness or even carbon-neutrality**
- **Strong potentials for efficient**
  - **re- and multi-use**
  - **degradability and**
  - **recyclability in so-called «cascade formats»**
- **New functions/properties of their products, like**
  - **longer lifetime**
  - **higher durability and stability**
  - **lower or zero emissions**
  - **less or no toxicity**
  - **non-flammability etc.**

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Principles

A Circular Economy is a regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing energy and material loops.

This can be achieved through

- **long-lasting design**
- **maintenance,**
- **repair**
- **reuse**
- **remanufacturing,**
- **refurbishing,**
- **and closed recycling …**

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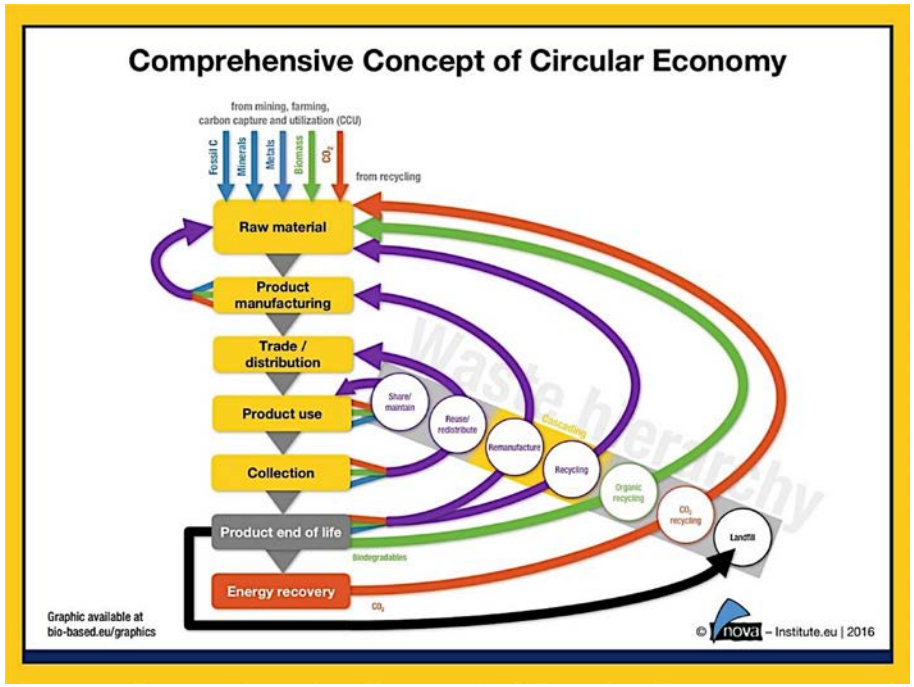
Principles

In a Circular Economy the value of products and materials is maintained for as long as possible. Waste and resource use are minimised, and when a product reaches the end of its life, it is used again ….. energy recovery



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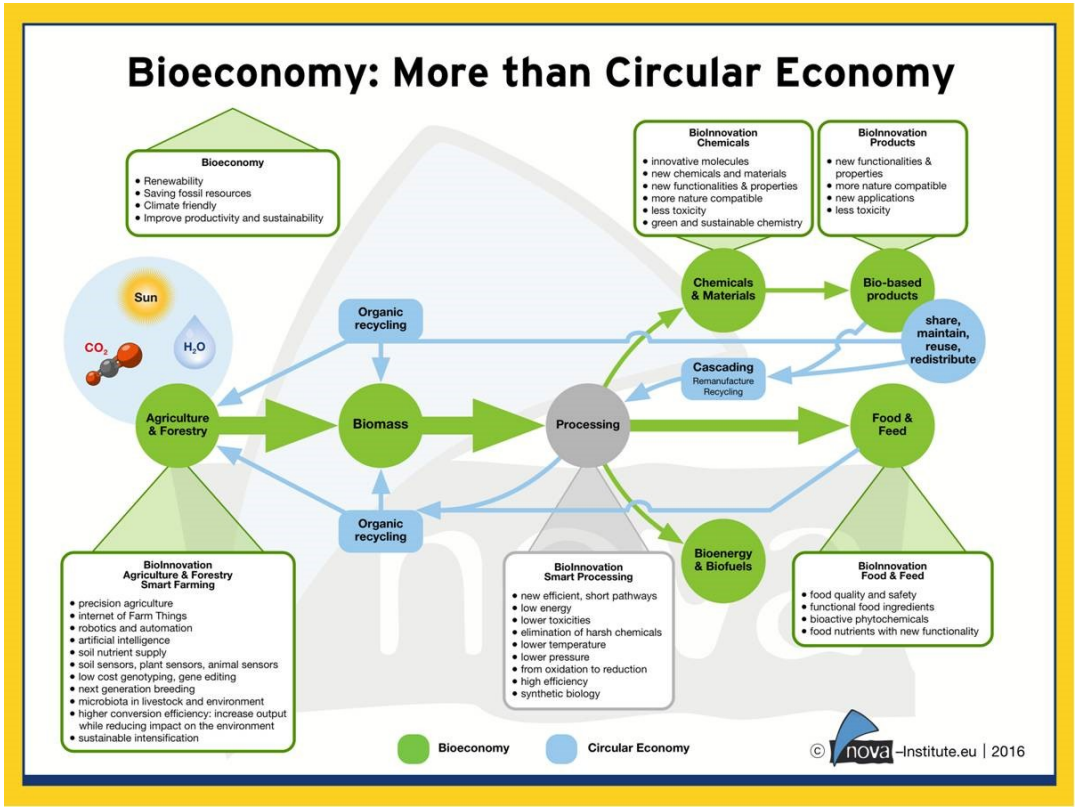
Principles

Bioeconomy is the biological power engine of the Circular Economy, not just an integral part of it. There is more and more talk about the sustainable Circular Bioeconomy.



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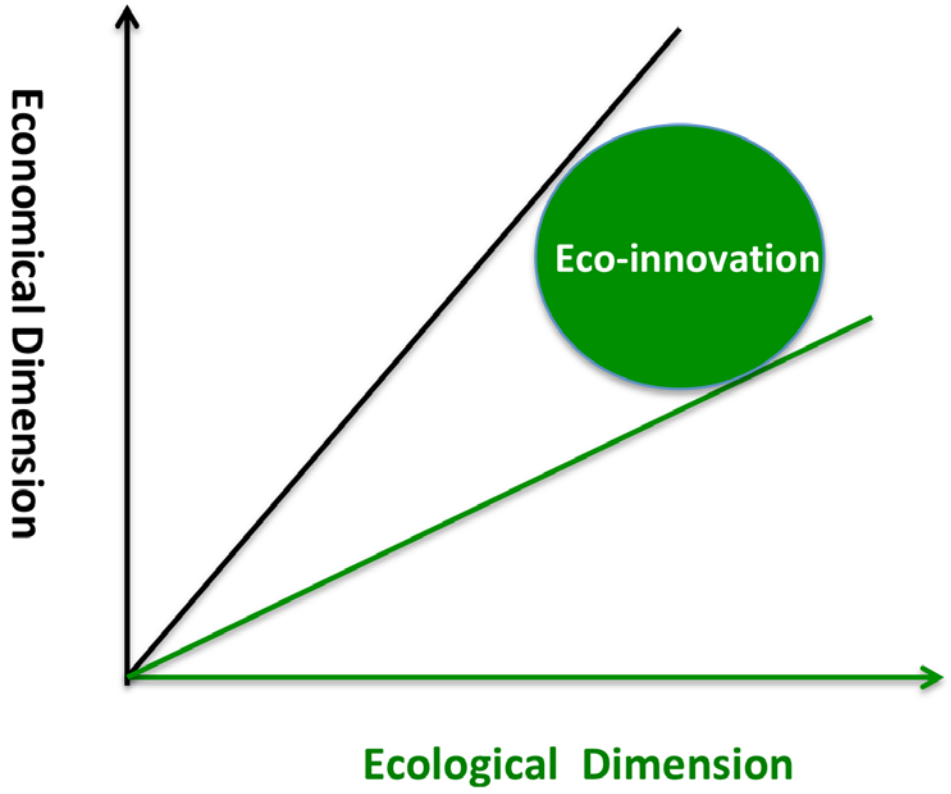
Principles



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Present status

More than 60 states worldwide and half a dozen regions officially support the bioeconomy *via*

- **dedicated programmes**
- **strategies**
- **action plans**
- **roadmaps**
- **closely related political programmatic and/or strategic activities.**

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Present status

- **Many of these activities are limited to biotechnology and/or biofuels production and use.**
- **Almost 12 years after BE launch there is no more a «single bioeconomy» but there are «many bioeconomies»!**
- **This has an impact on the necessary frameworks, public funding, private investment and thematical content.**

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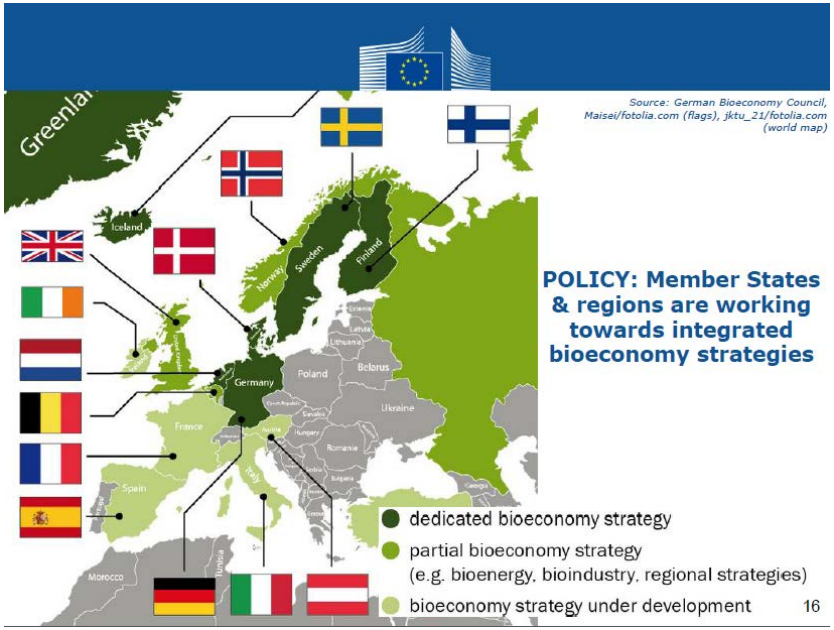
Present status

TREC Danube is a transnational network of regional clusters I in the field of renewable energy, energy systems and bioeconomy.



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Lessons learnt

Changes and lessons learnt in the last 12 years

- **Biomass remains the primary natural resource of the bioeconomy, be as a carrier for energy or a modular part for chemicals, biochemicals, proteins or nutrients, etc..**
- **Recently, CO_2 is added to the portfolio of primary natural resources of the bioeconomy.**

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Lessons learnt

- **Biorefineries will be the central production facilities of the bioeconomy.**
- **Biorefineries primary and not exhaustive feedstock will be biological waste resources and biomass: both of renewable nature.**

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Lessons learnt

The paradox

BE is a very complicated language with a very simple alphabet based on one single letter, the F.

4 Fs: Food, Fees, Fiber and Fuel

Future and Fun

Bioeconomy
Circular Economy
Global Goals for Sustainable Development

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Global Goal for Sustainable Development

Bioeconomy also comes in response to our attempt to cope with the challenges of the Global Goals for Sustainable Development set by UN (2015).

http://www.globalgoals.org

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Global Goal for Sustainable Development

Most of these goals are directly related to the Bioeconomy.
Of the 17 goals, the directly related goals of Sustainable Development and the Bioeconomy are the following:

Goal 2: Stop hunger, achieve food security and better nutrition and support sustainable agriculture.

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Global Goal for Sustainable Development

Goal 6: Availability and sustainable water management and ensuring hygiene facilities for all.

Goal 7: Ensure access to more affordable, sustainable, and modern energy sources for all.

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Global Goal for Sustainable Development

Goal 12: Ensure sustainable consumption and production patterns.

Goal 13: Take immediate action to combat climate change and its consequences.

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Global Goal for Sustainable Development (GGSD)

Goal 15: Protecting ecosystems, restoring them and supporting their sustainable exploitation, sustainable forest management, combating desertification, stopping soil degradation and reversing it, and putting an end to the loss of biodiversity.

These goals are interrelated and are also directly related to the 17 GGSD

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Global Goal for Sustainable Development (GGSD)

These BE goals are interrelated and are also directly related to the 17 GGSD

Bioeconomy
Circular Economy:
Open Questions

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Open issues

- **There is no coordinated effort among stakeholders.**
- **A national stakeholder platform, as proposed by the EC is still missing**
- **There is no strategy on biorefining. The industrial branches do *ad libitum* what they think is just useful**
- **There is too little coordination among the regions in every country or within Europe.**
- **There are no flagship projects to stress a stronger visibility (like in France, Italy, Finland).**

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Open issues

- **Missing coordinated efforts among various industrial branches to maximise exploitation of value chain systems, crossing cosmetics, food, feed, construction materials etc. Here we have still to do a lot and the interest is dramatically growing.**

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Open Issues

The Knowledge-Based Bio-Economy also raises societal concerns.

New issues arise, like:

- **use of human tissue and cells**
- **use of personal and genetic data**
- **food *vs* fuel**
- **environmental issues including sustainable use of biomass in countries of the 3rd world**
- **animal welfare issues, including animal cloning etc.**

All require monitoring and informed societal debate on its benefits and risks

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Key Issues

Some key questions

- **The central question is whether this is a realistic picture of the potential of the Bioeconomy, but also of its feasibility and the implications of its implementation.**
- **Can major environmental problems be solved by the Bioeconomy and how much can the Bioeconomy contribute?**
- **What is the contribution of Bioeconomy if it is implemented on a large scale?**

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Key Issues

Some key questions

- **Can we think of the unintended side-effects of an extensive Bioeconomy, which are still underestimated in the debate in view of its noble goals?**
- **Is the Bioeconomy, perhaps only ideologically critical, only the effort of powerful actors from politics, economics and science to pursue their work and their own interests under the noble mantle of environmental compatibility?**

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Future Design

The future design of the Bio-Economy in terms of environmental aspects and sustainability could include the following steps:

- **Analyse the positive and negative potential for sustainability of the different directions of the Bioeconomy and the proposed innovation paths as early as possible at the development stages.**
- **Study the extent of their success opportunities, problem solving and their limitations, in order to develop future paths of innovation in terms of both promoters and inhibitors.**

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Future Design

- **Analysis of the factors on which it depends, whether positive viability potential can be realized or that sustainability risks can be overcome at an early stage, with particular attention to recovery phenomena.**

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Future Design

- Comparison with the potential of non-bio-based technologies to achieve greater environmental sustainability and / or analysis of possible combinations of biotechnological and non-biological methods.

- Continue and implement this multi-stage process during the further development of the bioeconomy.

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Future Design

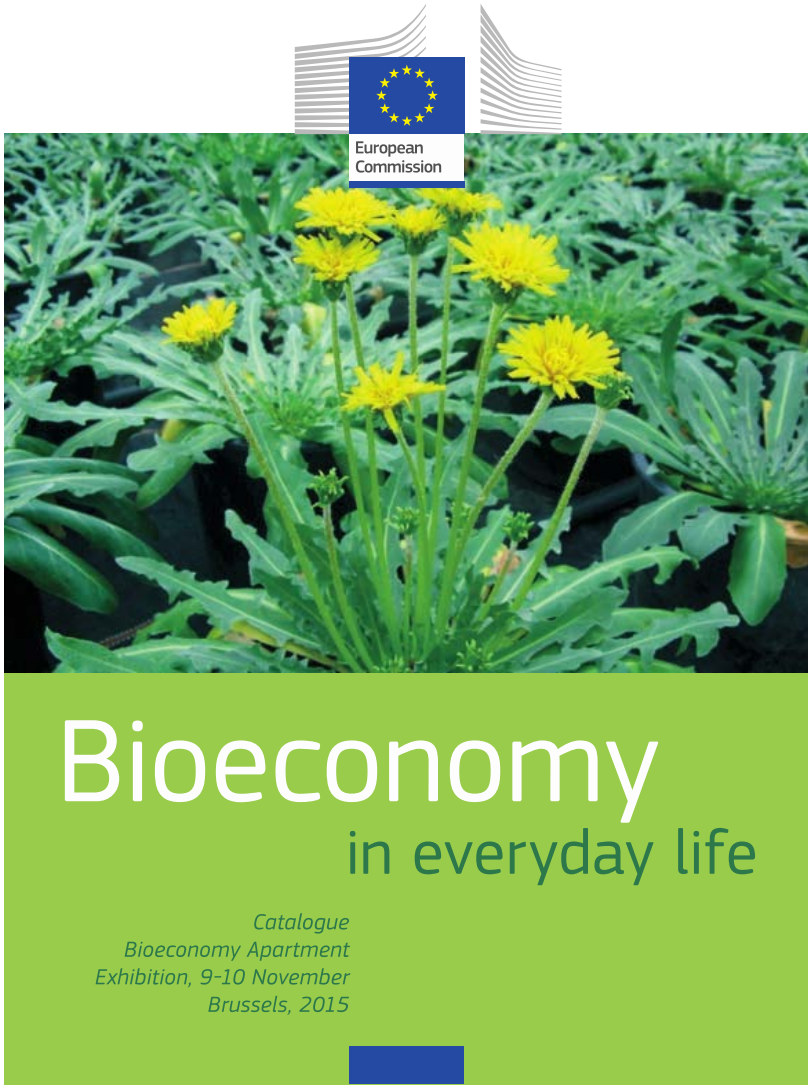
The design of the Bioeconomy should be a continuous learning process, based on the principles of sustainable development, which addresses the goals of design, implementation options, innovation pathways and even involuntary consequences.

Summarising

- BE is the renaissance of natural resources economy
- BE triggers new openings at interfaces of scientific and technological disciplines
- BE ought to be part of everyone's studies
- BE facilitate multiple ways to inflict social changes according to the UN-GGSD

Summarising

Bioeconomy in every day life is not a dream is a fact



The Bioeconomy and Sustainability symbol for Greece is the olive tree

Thank you very much for your attention